DOCUMENT RESUME

ED 453 049 SE 063 855

AUTHOR	McCormick, Bonnie; MacKinnon, Christy; Jones, R. Lynn
TITLE	Evaluation of Attitude, Achievement, and Classroom Environment in a Learner-Centered Introductory Biology Class.
SPONS AGENCY	National Aeronautics and Space Administration, Washington, DC.
PUB DATE	1999-03-00
NOTE	14p.; Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (Boston, MA, March 28-31, 1999). This project was funded by a grant from Project NOVA, NASA Opportunities for Visionary Academics.
CONTRACT	NAG5-4346
AVAILABLE FROM	For full text: http://www.narst.org/narst/99conference/mccormicketal/mccormicketal.html.
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Active Learning; *Biology; *Classroom Environment; Constructivism (Learning); Educational Change; Higher Education; *Integrated Curriculum; *Introductory Courses; Mathematics; Problem Solving; *Science Instruction; Technology
IDENTIFIERS	National Science Education Standards

ABSTRACT

According to the National Science Education Standards, science curricula should emphasize understanding, reasoning, and problem solving. In order to align with the standards, the learning environment should be an active learning environment rather than a lecture-centered format in postsecondary education. This study evaluates a new format for an introductory biology course which uses a learner-centered approach through an activity-based curriculum. (YDS)

Evaluation of Attitude, Achievement, and Classroom Environment in a Learner-Centered Introductory Biology Class

by

Bonnie McCormick
Christy MacKinnon
R. Lynn Jones

Evaluation of Attitude, Achievement, and Classroom Environment in a Learner-Centered Introductory Biology Class

Bonnie McCormick and Christy MacKinnon, University of the Incarnate Word, San Antonio; R. Lynn Jones, The University of Texas at Austin

Introduction

Many national organizations have called for reform in science education to extend to introductory science classrooms at the post secondary level. If systemic reform in science education is to succeed, there needs to be increased articulation among all parts of the system, including post secondary education (NSF, 1996a). Post secondary science education is important to systemic reform not only because these institutions train scientists and engineers, but also because these institutions prepare future users of science in a workplace transformed by the advances of science and technology and future teachers of science.

The teaching standards set forth by the National Research Council, (NRC, 1995) call for the science curriculum to emphasize understanding, reasoning, and problem solving. In order for post secondary science classes to be aligned with the standards for teaching as described by the NRC, the learning environment, including pedagogical methods, must change from a lecture centered format to an active learning environment, (NSF, 1996a). The active learning environment includes student involvement in discussion, hands-on activities, and small collaborative learning groups. This approach to teaching introductory science courses is particularly important in Texas, since pre service teachers are required to learn science in classes designed for the general population and are not required to take a science methods course.

The epistemological theory espoused in the standards, that "student understanding is actively constructed through individual and social processes" (NRC, 1995; p. 29) is equivalent to constructivism. Constructivist theory as a referent for teaching methods is an accepted strategy for improving teaching practice (Tobin, et al, 1993). One of the most valuable contributions of constructivist theories is the framework the theory provides for learner-centered instructional designs. In describing the learning paradigm, Barr and Tagg (1995, p. 15) propose that the purpose of higher education is not to transmit knowledge, but to create environments that allow learners to discover and construct knowledge for themselves.

The focus of this study is to evaluate a new format for an introductory biology course at the University of the Incarnate Word (UIW). The introductory biology course was restructured to create a learning environment that was consistent with those called for in the National Science Education Standards (NRC, 1995). A planning and implementation grant from NASA Project NOVA provided support for developing the revised course format. The purpose of Project NOVA is to support innovation in higher education courses that integrate science, technology, and mathematical principles. The support of Project NOVA helped convince faculty and administrators that a standards based curriculum revision was credible at the college level.

Course Structure

UIW is a small Catholic liberal arts institution located in San Antonio, Texas. UIW has a culturally and racially diverse student body of approximately 2700 full time students that reflect the demographics of the San Antonio community. The majority of these students enroll in a course titled "Diversity of Life" to satisfy part of the laboratory science requirement of the core curriculum. The course is required of all biology majors and pre service elementary teachers. The core curriculum goals that are satisfied by this course are to develop a working understanding of natural science, including an awareness of the implications of technology and respect for the natural world and to develop a personal philosophy that leads to informed moral and ethical choices. There is no prerequisite for the course. Sections of the course contain both majors and non majors.

This introductory course had traditionally been taught in a three-hour lecture format with a separate three-hour laboratory. The course description as stated in the university catalogue is "the evolution and diversity of living organisms, structure and function of plants and animals, and ecology; a foundation for advanced studies in biology". This is the only course that covers some key elements included on the state certification exam for teachers in Texas. The class is limited to 24 students per section. Small class size allows the opportunity for instructors to know the students and to reflect on individual progress and difficulties. The traditional method of teaching this course is oriented toward a transfer of knowledge method with assessment of students knowledge acquisition that focuses on factual recall at the knowledge and comprehension levels of Bloomís taxonomy.

The redesigned course is taught in a novel format with lecture and lab combined into a course that meets two days a week for three hours. This format allows the course to be taught using a learner-centered approach that engages the students in the process of discovering biological principles through an activity based curriculum. The course design follows the recommendations of NSF (1996a, p. 5), by changing the focus of instruction from memorization of facts to the mastery of concepts and applications, by changing the learning environment so that students take an active role in the process, by providing opportunities to apply technological tools to solve problems, and by assessing the abilities of students to reason and solve problems using scientific principles. Course content follows the conceptual framework recommended by BSCS (1993). Concepts covered during the semester are biological evolution, biodiversity, and ecological systems.

The redesigned course was offered for the first time during the 1997 ñ 1998 academic year. Lecture material was integrated with laboratory experiences. New activities and laboratory experiences were developed to supplement and extend the existing laboratory curriculum to achieve the stated objectives in the course syllabus. Course materials were developed and modified to incorporate the application of mathematical principles to the study of biology. Mathematical principles implemented in the course curriculum include:

1. Calculating and graphing exponential curves;
2. Applying the use of Venn diagrams to classification;
3. Evaluating the adaptive significance of surface to volume ratios;
4. Predicting genetic composition of populations using quadratic equations;
5. Comparing cell structures of eukaryotic cells with prokaryotic cells using ratios and proportions;
6. Analyzing and presenting numerical results.

Technological resources were used to gather information and data from university and government operated web sites. Computer software available through the Internet and graphing calculators were used by the students in the course to facilitate data analysis and data presentation. Students were trained in the use of these technological resources and were required to apply the use of technology throughout the course. PowerPoint presentations provided students with class notes and background information. Laboratory aids for studying microscopic organisms were developed using video cameras and image grabbing software. Students were able to share observations using video microscopy.

The instructional model for the course was a learning cycle approach (Lawson, et al, 1989; Bybee, 1993). Students were introduced to new material by engaging in an activity or discussion of a question posed to the class. Exploration of the concept with an activity or laboratory experience is followed by an explanation of terms and concepts. Group and whole class discussion replaced the lecture component of the course. Students apply what they have learned during the elaboration phase of the learning cycle. Evaluation is the last stage of the learning cycle. Students were assessed by discussion questions and performance exams. Student activity and laboratory notebooks, reflections on reading assignments, and portfolios provided a means of assessing student performance in an active learning environment.

Evaluation of Course Redesign

The course was evaluated with pretest and posttest comparisons of the experimental group and the control group. The questions investigated by the study were:

1. Are there differences between student attitudes toward science and prior knowledge of science in the control and experimental section?
2. Do biology students prefer a learner-centered model of teaching?
3. Did students perceive that the course was taught using a model consistent with a learner-centered environment?
4. Did instruction affect student attitude toward science?
5. Did the instructional design affect content acquisition?

The subjects of the study were students enrolled in the introductory biology classes identified as the control and experimental groups. The number of students included in the study was determined by the number of students who agreed to complete the instruments and by the number of pretests and posttests that could be matched. Most subjects lost during the data collection process were due to a failure to provide a student identification code.

Pretests and posttests were used to evaluate content acquisition, change in attitude toward science, and student perception of the learning environment as a result of the instructional model. The independent variable is the manner of instruction. The experimental group was taught using a learner-center curriculum that integrated laboratory investigations and activities related to course objectives. The control group received instruction in a traditional lecture format with a separate laboratory period. The dependent variables are student attitudes toward science, perceptions of the learning environment, preferred learning environment, and gains in content knowledge. The control variables are class size, experience of the instructors, content coverage, total hours of instruction, ethnicity and racial background of the students, and age of the students. Results were evaluated for statistical significance by ANOVA at an alpha level of 0.05.

Instrumentation

The Constructivist Learning Environment Survey (CLES) reported by Taylor et al, (1995), was used to investigate the students' preferred learning environment and perceived learning environment. The purpose of the survey is to determine if the course is taught in a manner consistent with constructivist learning theory. The survey instruments contain 25 Likert scale items designed to enable researchers to monitor constructivist approaches to instructional design (Taylor, et al, in press). There are five scales to measure the occurrence of five dimensions of a constructivist learning environment. These five scales are:

1. Personal Relevance ñ relevance of learning to studentsí lives;
2. Uncertainty ñ awareness of the provisional nature of scientific work;
3. Critical Voice - ability of students to express their opinion;
4. Shared Control ñ participation in planning, carrying out, and assessing the learning process;
5. Student negotiation ñ interaction with other students in evaluating viability of new ideas.

The attitudes of the students were measured using a 29 item Likert scale adapted from a survey developed by Sundberg, et al,

1994. Responses were coded so that a high score approached what the developers of the survey considered to be an expert response. Knowledge gains were assessed by multiple choice questions of the type used on the AP biology and questions from the test bank that supports the course text. The response items are divided into five subscales. The subscales are:

1. Institution requirements,
2. Science in everyday life,
3. Personal comfort with science,
4. Power and limits of science,
5. Science and religion.

Content knowledge was assessed with multiple choice questions of the type found on the AP Biology Exam and questions from the test bank that supports the course text. The assessment of content knowledge for the course evaluation was not part of student assessment for individual course grades. The posttest was given the final week of the course. Students were not given prior notice that the posttest would be given.

Findings

An analysis of the CLES found that there was no difference between the experimental and control in the total scores for preferred learning environment (Fig. 1). There was a statistically significant difference in the total perceived learning environment score. The experimental group perceived that the overall learning environment was more consistent with a constructivist learning environment than the control group (Fig. 2). There was a highly significant difference in the subscale of student negotiation. Results of the analysis of the CLES scores is summarized in Table 1.

There was no statistically significant difference between the experimental and control groups on the pre and posttests of course content (Table 2), in spite of the fact that multiple choice tests of content knowledge were not a major part of classroom assessment in the experimental section. This indicates that students can learn as much content in an environment that emphasizes concepts and application rather than memorization of textbook facts.

No significant difference was found between the experimental and control groups on the attitude toward science scale as evaluated by analysis of the pretests (Table 3). Students in the experimental and control groups showed no significant change in attitude based on scores on the total scale. Analysis of the control groups scores showed that there was a statistically significant difference in the subscale that measures attitude toward science and religion. This is especially worrisome in an environment where one of the institutional goals is to enforce the differences of science as a way of knowing and other ways of knowing. A lower score on this scale indicates that respondents are more willing to accept scientific ways of knowing in all situations, including those that require moral and ethical judgments. The number of posttests that could be matched to pretests for the attitude inventory was very low which limited the possibility of significant findings.

These preliminary findings suggest that a learner-centered environment can be as effective as traditional lecture method of teaching science content at the introductory level. The CLES was useful in evaluating student desire for learner-centered environment and their perception of whether the redesigned course was better able to provide a desirable environment from the point of view of the learner. Although there was no significant difference in content acquisition, the quality of the educational experience from the learnerís point of view is an important component of the educational experience. Modeling methods of learner-centered teaching methods can be valuable to those who are prospective teachers, whether they are become K-12 teachers, graduate teaching assistants, residents in a teaching hospitals, or teachers of their own children. Repeat studies are being conducted to confirm and extend these findings.

Significance

Learner-centered course design increases the workload for both the faculty member as well as the student. Faculty need support from research to evaluate the benefits of this type of learning environment. Change will not occur unless it can be demonstrated that learner-centered classroom environments are more effective in retaining student attitude and are at least as effective in content acquisition as the traditional lecture method of teaching.

The study has implications for the training of pre service teachers through their experience in a science content course by providing an instructional model that is consistent with the goals of systemic reform and the way these teachers should eventually teach science. This instructional model is particularly important since research suggests that teachers tend to teach the way they were taught as undergraduates (NSF, 1996b). Moreover, a learner-centered model of instruction may provide a model of standards based teaching for many other future stakeholders in the educational system as well as providing the general education student with the skills to understand science related issues in their daily lives.

By demonstrating the effectiveness and feasibility of teaching introductory biology in the proposed lecture and lab combined format, the results of this study contribute to the development of a model for post secondary instruction that is learner-centered and to changing the culture of teaching science at the post secondary level through research based recommendations.

This project was funded by a grant from Project NOVA, National Aeronautics and Space Administration Grant Number NAG5-4346.

References

BSCS. 1993. *Developing Biological Literacy.* Dubuque, Iowa: Kendall Hunt.

Barr, R. B. and Tagg. 1995. From teaching to learning ñ A new paradigm for undergraduate education. *Change* . Nov./Dec., 13-25.

Lawson, A. 1988. Student reasoning, concept acquisition, and a theory of science instruction. *Journal of College Science Teaching* . 17, 314-316.

National Research Council. 1995. *National Education Standards* . Washington, D. C.: National Academy Press.

National Science Foundation. 1989. Report on the workshop on undergraduate biology education. *Journal of College Science Teaching* , 19(3), 74-81. Arlington, VA: NSF.

National Science Foundation. 1996a. *The learning curve: What we are discovering about U. S. science and mathematics education.* Arlington, VA: NSF.

National Science Foundation. 1996b. *Shaping the future: New expectations for undergraduate education in science, mathematics, engineering, and technology* . Arlington, VA: NSF.

Sundberg, M. D., Dini, M. L., and Li, E. 1994. Decreasing course content improves student comprehension of Science and attitudes towards science in freshman biology. *Journal of Research in Science Teaching* , 31(6), 657-678.

Taylor, C.P., Dawson, V., and Fraiser, J. B. 1995. Classroom learning environments under transformation: A constructivist Perspective. Paper presented at the annual meeting of the American Educational Research Association. San Francisco, 18-21 April, 1995.

Taylor, C. P., Fraiser, J. B., and Fisher, D. L. in press. Monitoring Constructivist Classroom Learning Environments. *International Journal of Educational Research.*

Tobin, K., Tippins, D. J., and Gallard, A. J. 1993. Research on instructional strategies for teaching science in *Handbook of Research on Science Teaching and Learning,* D. Gabel, Ed. 45-93. New York: Macmillan.

Table 1. Summary of Results of the CLES

Comparison (125 points possible except as noted)	Experimental n	Average	Control n	Average	P-value
Preferred Experimental vs Preferred Control	23	103.26	20	96.9	0.13
Preferred Experimental vs Preferred Control ñsubscale 3 ñ Critical Voice (25 possible points)	23	20.52	20	17.85	0.056
Perceived Experimental vs Perceived Control	16	92.44	19	82.63	*0.03
Perceived Experimental vs Perceived Control Subscale 5- Student Negotiation (25 possible points)	16	23.00	19	15.95	*6.21 E -07

Table 2. Summary of Results from the Content Knowledge Instrument

Comparison (29 possible points)	Experimental n	Average	Control n	Average	P-value
Pretest Experimental vs Posttest Experimental	15	10.47	15	15.07	*0.001
Pretest Control vs Posttest Control	13	10.38	13	14.77	*0.004
Pretest Experimental vs Pretest Control	15	10.47	13	10.38	0.94
Posttest Experimental vs Posttest Control	15	15.07	13	14.47	0.85

Table 3. Summary of Results from the Attitude Survey

Comparison	Experimental n	Average	Control n	Average	P-value
Pretest Experimental vs Pretest Control	14	108.43	10	112.0	0.43
Pretest Experimental vs Posttest Experimental	14	108.43	14	106.07	0.63
Pretest Control vs Posttest Control	10	112.0	10	108.3	0.37
Posttest Control vs Posttest Control Scale 5	10	21.6	10	18.7	*0.05

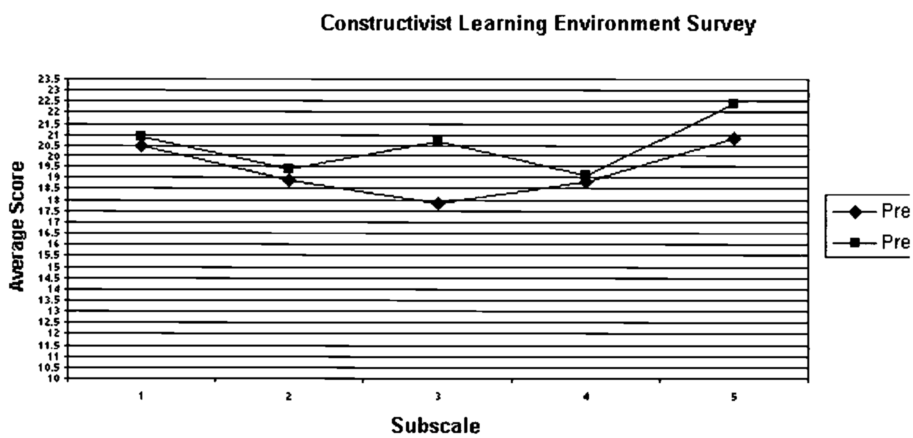

Figure 1. Preferred Learning Environment

BEST COPY AVAILABLE

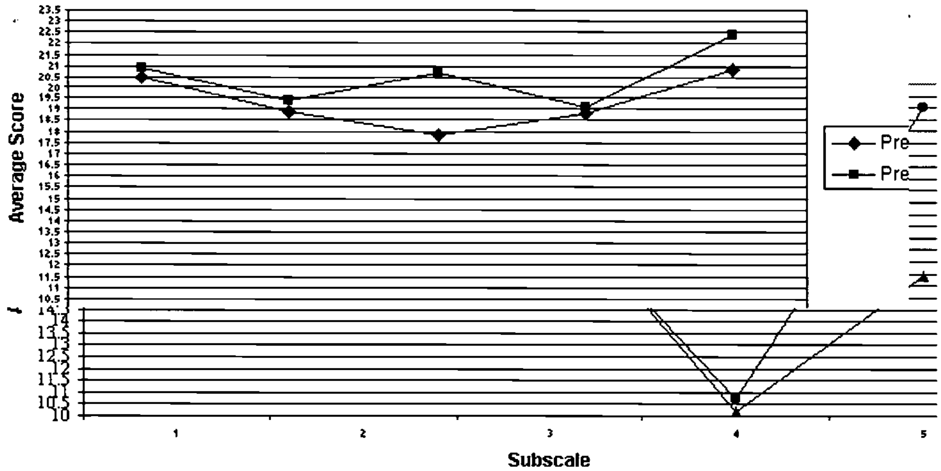

Figure 2. Perceived Learning Environment

Table 1. Attitude Pretest/Posttest Comparison of Control Section						
Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Column 1	10	1120	112	60.88889		
Column 2	10	1083	108.3	105.1222		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	68.45	1	68.45	0.824644	0.375824	4.413863
Within Groups	1494.1	18	83.00556			
Total	1562.55	19				

Table 2. Attitude Pretest/Posttest Comparison of Experimental Section

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	14	1518	108.4286	152.8791
Column 2	14	1485	106.0714	167.1484

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	38.89286	1	38.89286	0.243059	0.626143	4.2252
Within Groups	4160.357	26	160.0137			
Total	4199.25	27				

Table 3. Comparison of Experimental and Control Attitude Pretest

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	14	1518	108.4286	152.8791
Column 2	10	1120	112	60.88889

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	74.40476	1	74.40476	0.645613	0.430282	4.300944
Within Groups	2535.429	22	115.2468			
Total	2609.833	23				

Table 4. Attitude Scale 5 Pre/Post Comparison for Control

Anova: Single Factor	prepost5con

SUMMARY				
Groups	*Count*	*Sum*	*Average*	*Variance*
Column 1	10	216	21.6	6.488889
Column 2	10	187	18.7	13.34444

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	42.05	1	42.05	4.240336	0.054242	4.413863
Within Groups	178.5	18	9.916667			
Total	220.55	19				

Communication Post Experimental vs Control

Anova: Single Factor

SUMMARY				
Groups	*Count*	*Sum*	*Average*	*Variance*
Column 1	16	368	23	5.733333333
Column 2	19	303	15.94737	16.16374269

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	432.0241	1	432.0241	37.82170982	6.2099E-07	4.139252
Within Groups	376.9474	33	11.42265			
Total	808.9714	34				

post comparison control vs experimental

Post control vs experimetnal

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	19	1570	82.63158	135.9123
Column 2	16	1479	92.4375	182.9292

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	835.1843	1	835.1843	5.310054	0.027636	4.139252
Within Groups	5190.359	33	157.2836			
Total	6025.543	34				

pre expperimental vs controlcomparison cles

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	23	2375	103.2609	181.8379
Column 2	20	1938	96.9	178.4105

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	432.835	1	432.835	2.401309	0.128919	4.078544
Within Groups	7390.235	41	180.2496			
Total	7823.07	42				

Anova: Single Factor Content prepostex

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	15	157	10.46667	7.980952
Column 2	15	226	15.06667	16.20952

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	158.7	1	158.7	13.12087	0.001145	4.195982
Within Groups	338.6667	28	12.09524			
Total	497.3667	29				

Anova: Single Factor Content control prepost

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	13	192	14.76923	16.19231
Column 2	13	135	10.38462	7.75641

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	124.9615	1	124.9615	10.43576	0.003567	4.259675
Within Groups	287.3846	24	11.97436			
Total	412.3462	25				

Anova: Single Factor Content Control/experimental pretests

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	13	135	10.38462	7.75641
Column 2	15	157	10.46667	7.980952

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.046886	1	0.046886	0.005952	0.939095	4.2252
Within Groups	204.8103	26	7.877318			
Total	204.8571	27				

Anova: Single Factor Content posttests

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	15	226	15.06667	16.20952
Column 2	13	192	14.76923	16.19231

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.616117	1	0.616117	0.038028	0.846902	4.2252
Within Groups	421.241	26	16.20158			
Total	421.8571	27				

SE063855

ERIC

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

REPRODUCTION RELEASE

(Specific Document)

I. DOCUMENT IDENTIFICATION:

Title: Evaluation of Attitude, Achievement, and Classroom Environment in a Learner-Centered Introductory Biology Class

Author(s): Bonnie McCormick, Christy MacKinnon, R. Lynn Jones

Corporate Source:	Publication Date:
Presentation to 1999 NARST Annual Meeting Boston MA	March 1999

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic media, and sold through the ERIC Document Reproduction Service (EDRS). Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce and disseminate the identified document, please CHECK ONE of the following three options and sign at the bottom of the page.

The sample sticker shown below will be affixed to all Level 1 documents	The sample sticker shown below will be affixed to all Level 2A documents	The sample sticker shown below will be affixed to all Level 2B documents
PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY ✓ TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 1	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE, AND IN ELECTRONIC MEDIA FOR ERIC COLLECTION SUBSCRIBERS ONLY, HAS BEEN GRANTED BY TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 2A	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 2B
Level 1 X	Level 2A X	Level 2B X
Check here for Level 1 release, permitting reproduction and dissemination in microfiche or other ERIC archival media (e.g., electronic) *and* paper copy.	Check here for Level 2A release, permitting reproduction and dissemination in microfiche and in electronic media for ERIC archival collection subscribers only	Check here for Level 2B release, permitting reproduction and dissemination in microfiche only

Documents will be processed as indicated provided reproduction quality permits.
If permission to reproduce is granted, but no box is checked, documents will be processed at Level 1.

I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate this document as indicated above. Reproduction from the ERIC microfiche or electronic media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries.

Sign here, please

Signature: Bonnie McCormick	Printed Name/Position/Title: Bonnie McCormick Ph.D. Ass. Professor	
Organization/Address: University of the Incarnate Word 4301 Broadway San Antonio, TX 78209	Telephone: 2108249850	FAX: 2108293153
	E-Mail Address: mccormic@universe.uiwtx.edu	Date: